

Leadership Development Program Final Project

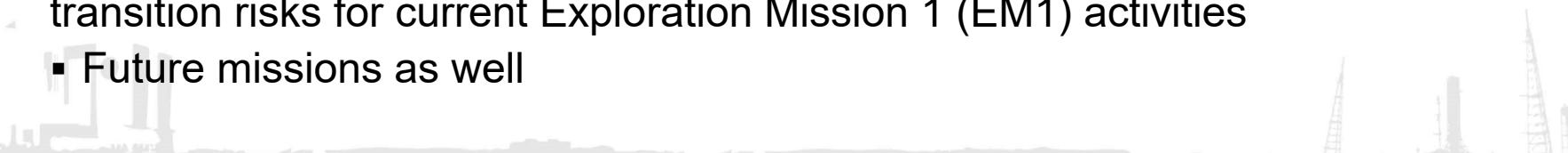


◆ Activity

- Define and capture the critical job performance information & data associated with the Senior Vehicle Engineer (SVE) and Associate Chief Engineer (ACE) positions
 - Job Description (roles & responsibilities)
 - Reference data

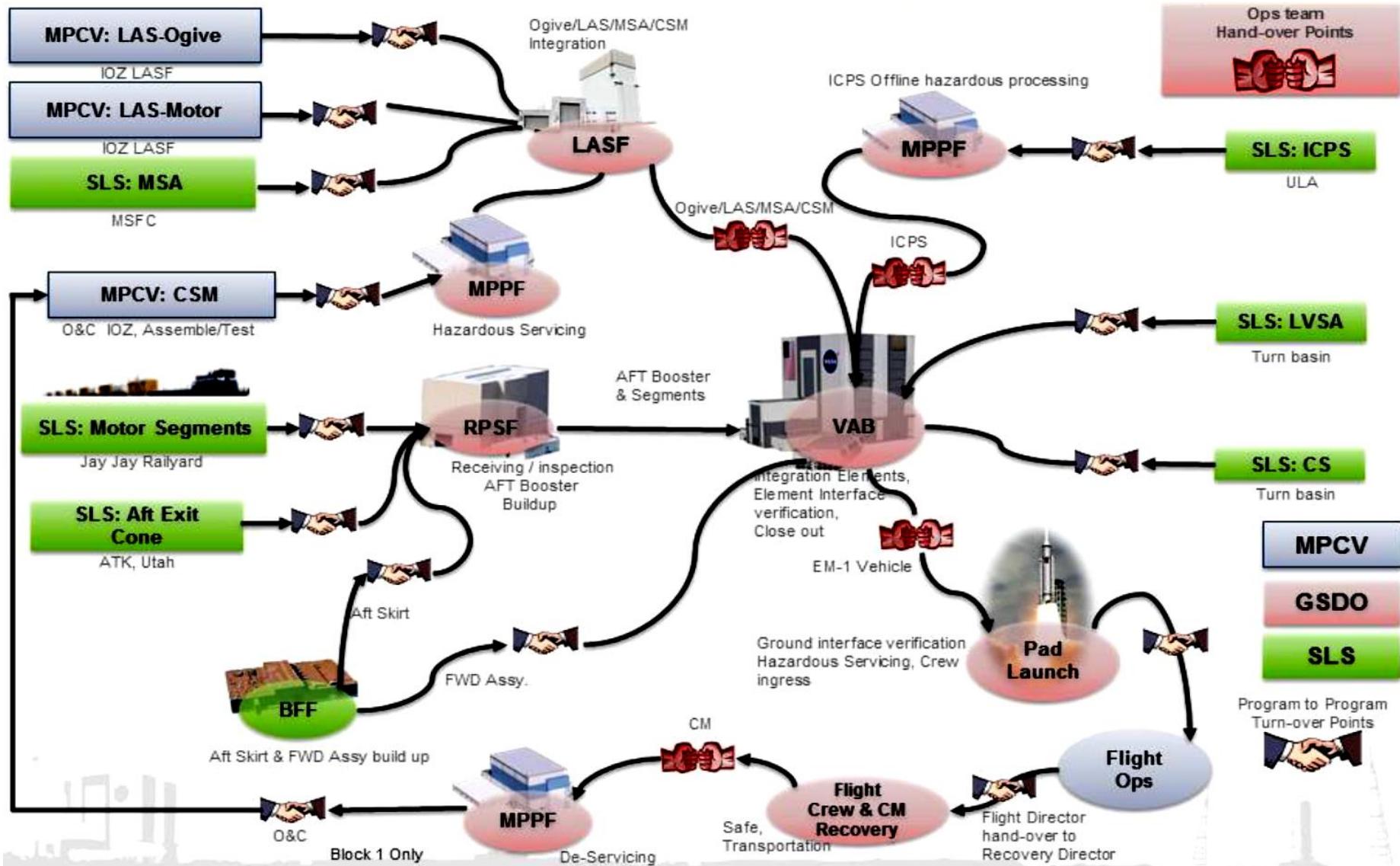
◆ Value

- The Test Operations & Support Contract (TOSC) SVE & ACE positions were created to resolve high level issues & integrate product deliverables for KSC
- Primary points of contact for KSC NASA customer & for the Original Equipment Manufacturer's (OEM's) – Boosters, Core Stage, etc...
- Capturing pertinent data associated with the SVE & ACE positions mitigates transition risks for current Exploration Mission 1 (EM1) activities
 - Future missions as well

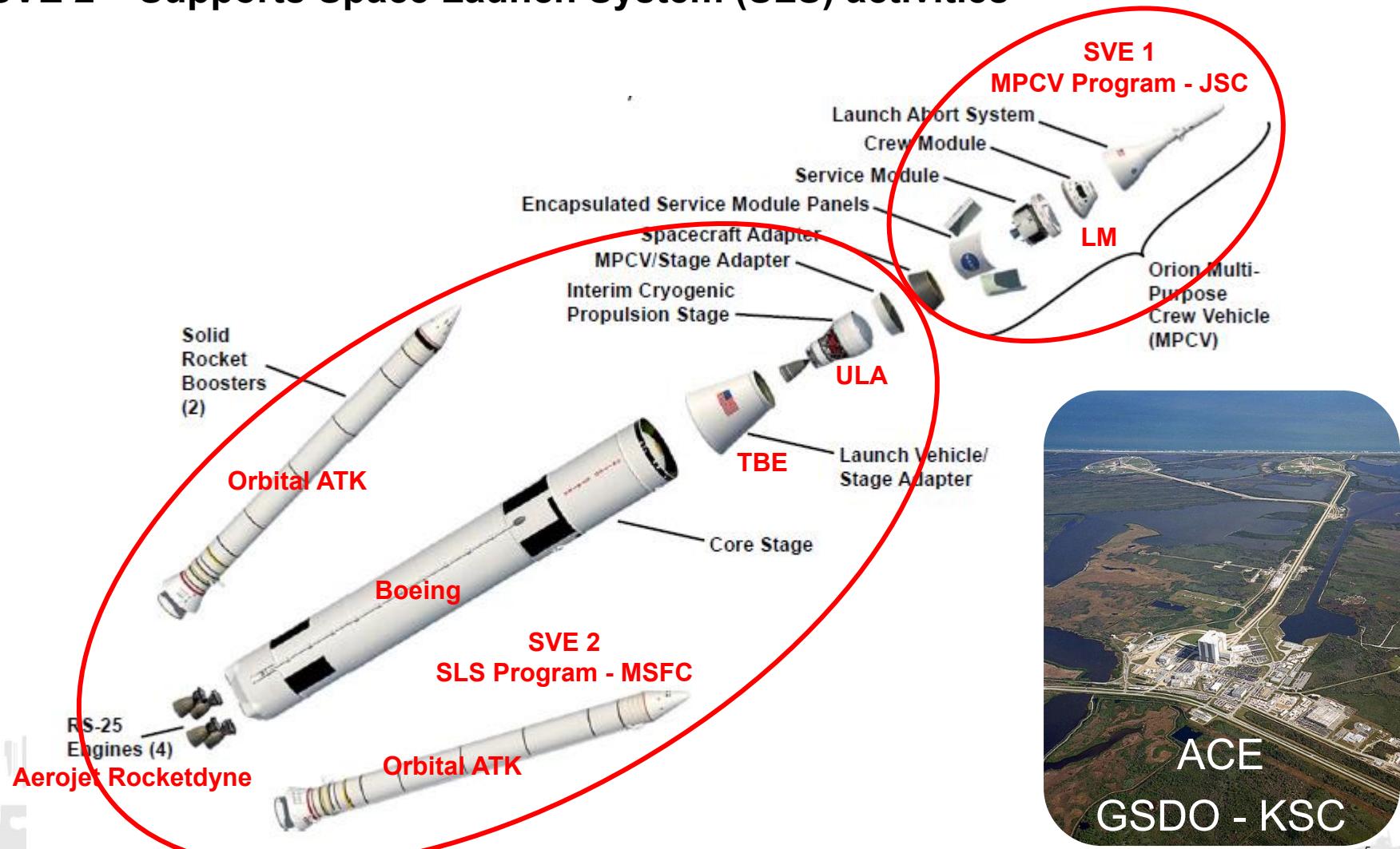


- ◆ **TOSC is NASA's prime contractor tasked to successfully assemble, test, and launch the EM1 spacecraft**
 - TOSC success is highly dependent on design products from the other NASA Programs – manufacturing and delivering the flight hardware
 - SLS – Space Launch System
 - MPCV – Multi-Purpose Crew & Vehicle
- ◆ **Design products directly feed into TOSC's:**
 - Procedures
 - Personnel training
 - Hardware assembly
 - Software development
 - Integrated vehicle test and checkout
 - Launch
- ◆ **TOSC senior management recognized a significant schedule risk as these products are still being developed by the other two (2) programs**
 - SVE & ACE positions were created

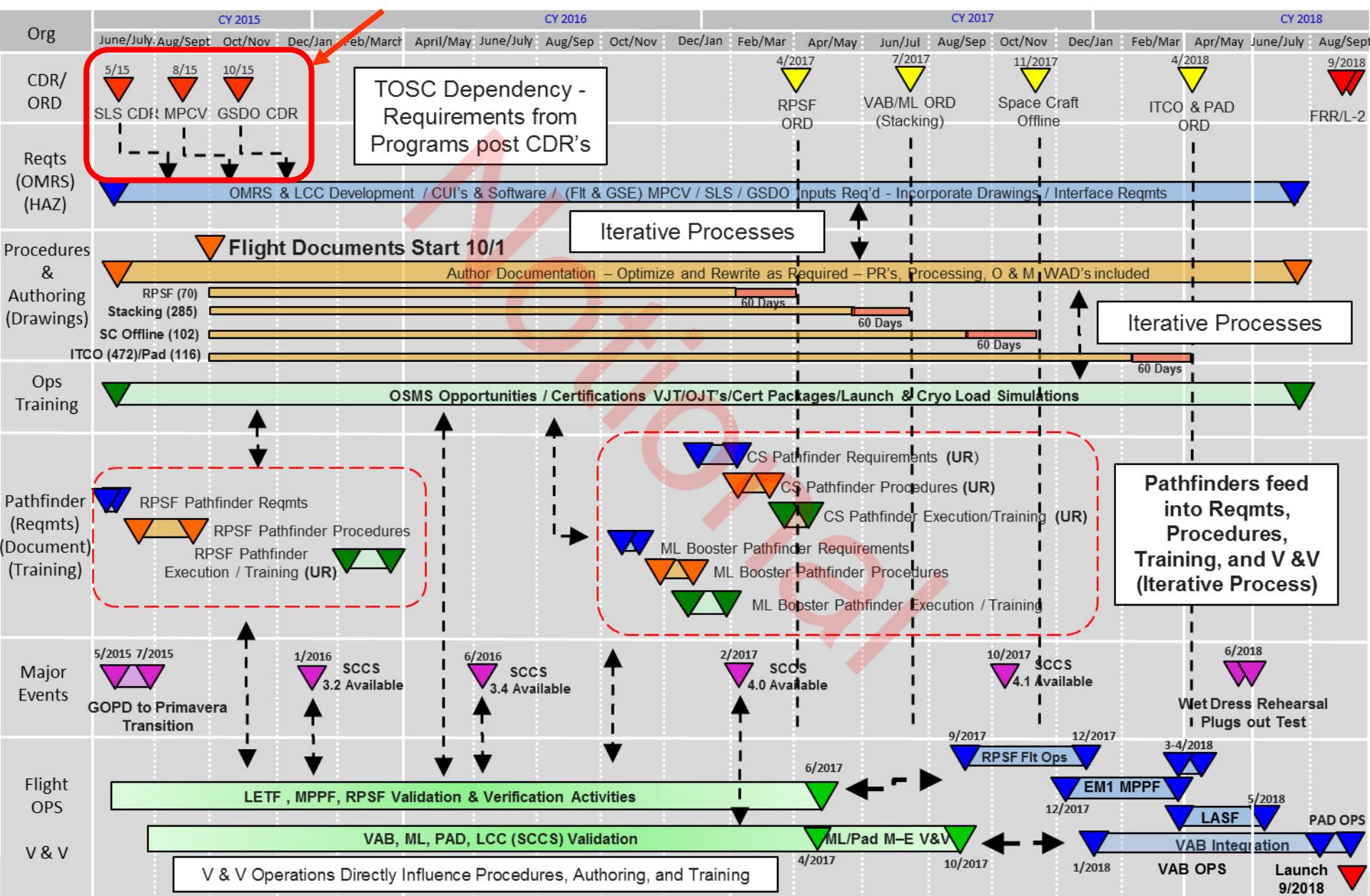
Multiple Handoffs – Products Required prior to Hardware



- ◆ ACE – Supports Ground System Development & Operations (GSDO) activities
- ◆ SVE 1 – Supports Multi-Purpose Crew Vehicle (MPCV) activities
- ◆ SVE 2 – Supports Space Launch System (SLS) activities



Design Products - SVE Focus – Impact Downstream Events



- ◆ **NASA's Program (MPCV/GSDO/SLS) contract deliverables are not integrated**
 - Drawings / GSE User Data / OMRS requirements
- ◆ **NASA developed BDEALS (Bi-lateral Exchange Agreements Lists & Schedule) between programs for early deliverables vs OEM contract changes**
- ◆ **SVE's currently leading & integrating BDEALS agreements – will provide basis for anchoring a viable schedule & cost reduction (no contract changes)**

| SLS & TOSC Partnering Status | | | |
|------------------------------|----------------------------|----------------------------|------------------------------------|
| SLS Element | SLS Contractor | Final Drawing Deliverables | TOSC Drawing Dates - I/W |
| Core Stage | Boeing | 4/1/2018 | 11/1/2016 1/31/2017 3/1/2017 |
| ICPS | ULA / Boeing | 12/14/2017 | 3/17/2017 |
| Engines | Aerojet Rocketdyne | 2/28/2017 | 2/28/2017 |
| LVSA | Teledyne Brown Engineering | 12/14/2017 | 3/17/2017 |
| Booster | OATK | 8/2016 11/2016 | BDEALS already in place |

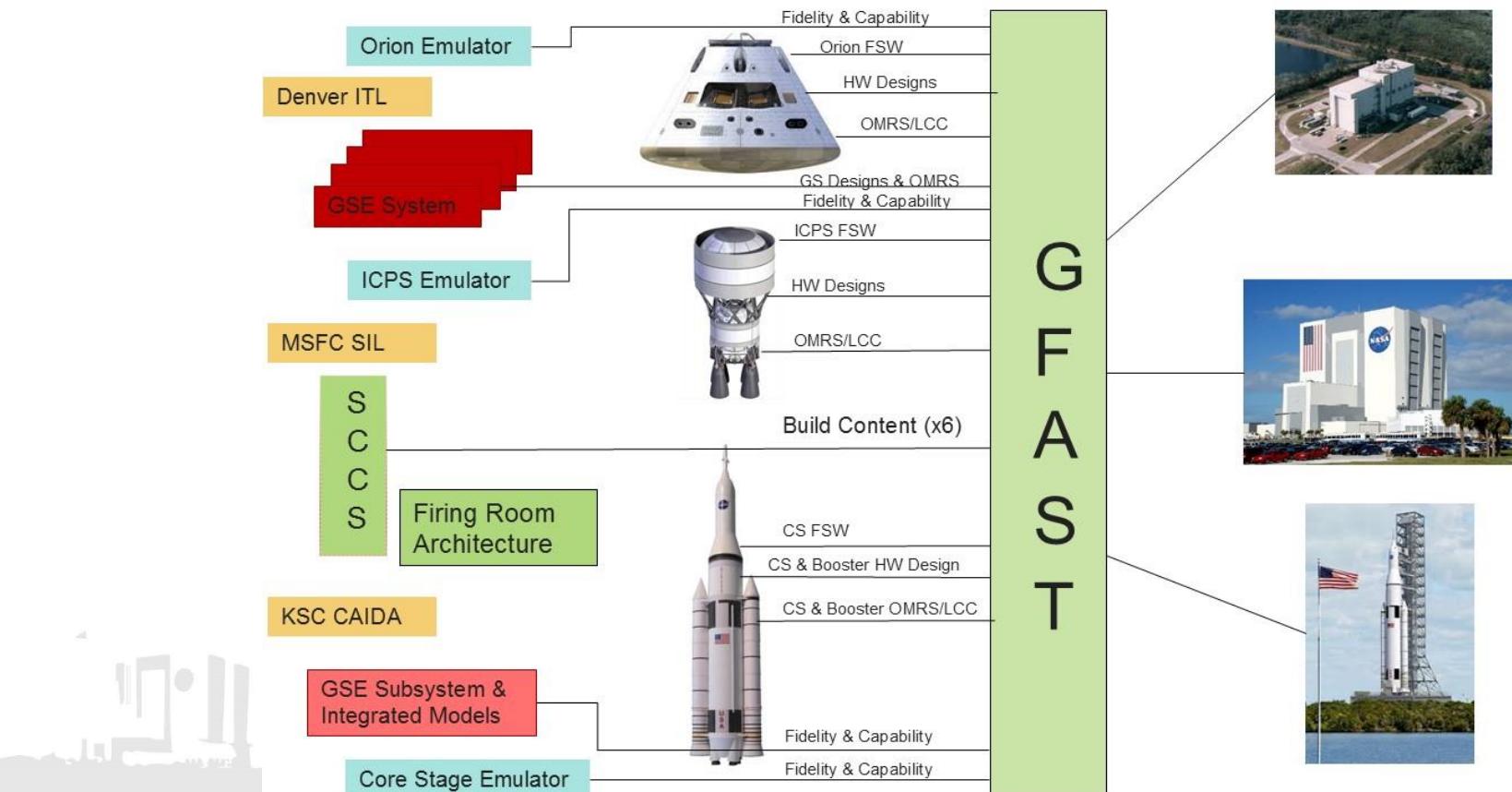
- ◆ **List of procedures captured by Facility/Location**
 - Totals are the current Engineering estimate – potential 10% - 20% growth

| EM-1 Processing WAD Estimate (8/15/2016) | | | |
|--|-------------|--------------|-------------|
| | Shelf Dates | Document QTY | Totals |
| S/C Offline | 10/2017 | | |
| MPPF | | 102 | |
| LASF | | 22 | |
| O & C | | 4 | |
| Landing & Recovery | | 4 | |
| Subtotal | | | <u>132</u> |
| RPSF | 7/2017 | | <u>87</u> |
| Stacking | 11/2017 | | <u>234</u> |
| ITCO & Pad | 2/2018 | | |
| VAB ITCO | | 494 | |
| PAD WDR & Launch | | 139 | |
| Subtotal | | | <u>633</u> |
| Total Estimate | | | <u>1086</u> |

WAD final approval dates based on 60 days from 1st use of procedures – GSDO goal

- ◆ **Current WAD schedule based on these estimates & dependency availability**

- ◆ GFAST provides the software for control & monitoring of flt vehicle during processing, testing, checkout, countdown, and launch
 - Includes integration of Ground Support Equipment (GSE) and flight data
- ◆ GFAST's work flow consists of development, implementation, integration, verification, and validation – currently teams are in the development phase
 - Many engineering products (OEM reqmts) and activities feed into this development effort



- ◆ **Significant risk occurred to GFAST team development schedules**
 - Immature technical requirements were not sufficient to allow continued software development

- ◆ **SVE's established a process to assess the technical maturity of the requirements & prioritization ranking for each of the flight software teams**
 - Near term priorities established with Rankings of 1, 2, 3
 - Aligned development cadence with operations needs
 - R Y G established to ensure GFAST teams had technical data in reqmts

- ◆ **Positive impact to EM1 activity – rankings still being utilized**
 - Approximately 1700 reqmts assessed for priority and maturity

Summary of Data (Red / Yellow / Green) Assessed in OMS Tool

| | Core Stage | | Booster | | Engines | | ICPS | | Totals - Split | |
|--------|------------|------------|-----------|------------|------------|-----------|-----------|-----------|----------------|------------|
| Status | WADs | GFAST | WADs | GFAST | WADs | GFAST | WADs | GFAST | WADs | GFAST |
| Red | 5 | 35 | 3 | 4 | 4 | 0 | 4 | 22 | 16 | 61 |
| Yellow | 29 | 145 | 16 | 40 | 40 | 5 | 32 | 53 | 117 | 243 |
| Green | 77 | 82 | 50 | 67 | 70 | 28 | 20 | 20 | 217 | 197 |
| Totals | <u>111</u> | <u>262</u> | <u>69</u> | <u>111</u> | <u>114</u> | <u>33</u> | <u>56</u> | <u>95</u> | <u>350</u> | <u>501</u> |

- ◆ TOSC established a method to determine the roles & responsibilities of the OEM's to support TOSC during hardware assembly and checkout
- ◆ Operational Agreements (OA's) with the OEM's were chosen and are I/W
- ◆ Pre-coordinate and identify specific tasks TOSC wants OEM presence for & identify any training "gaps" / special processes required
 - Minimize cost & proactive approach to acquire training / certification in advance
 - OA approval cycle shown below – making significant progress for EM1

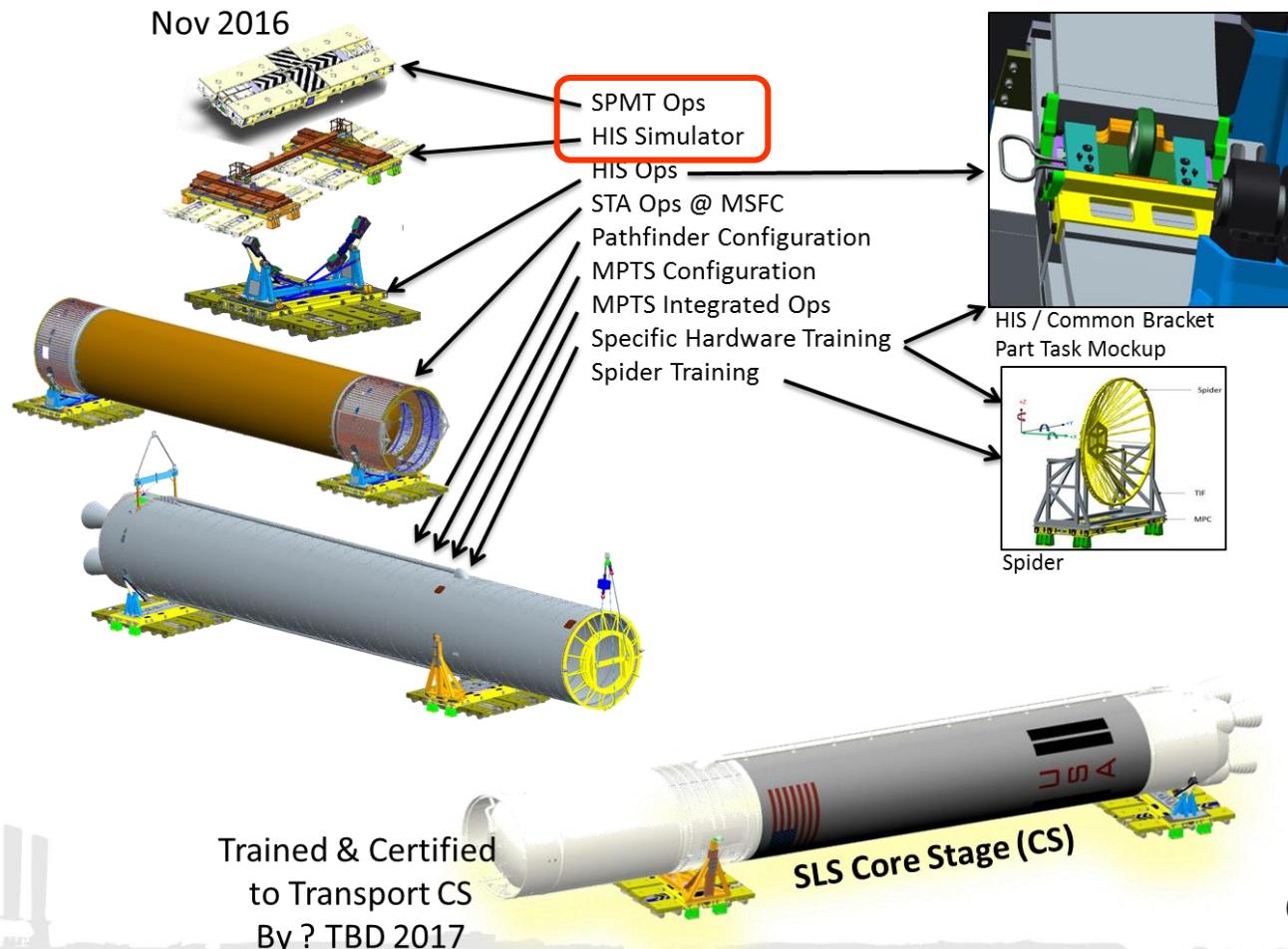
| OEM | Element | TOSC Review | OEM Review | NASA Review | OA Approved |
|------------|------------|-------------|---------------|-------------|-------------|
| OATK | Booster | ✓ | ✓ | 9/14/16 | 9/30/16 |
| Boeing | Core Stage | ✓ | ✓ | 9/14/16 | 10/14/16 |
| Boeing ULA | ICPS | 9/22/16 | ✓ (9/6/16) | 10/14/16 | 10/31/16 |
| TBE | LVSA | ✓ | ✓ | 9/14/16 | 10/14/16 |
| LM | Orion | ✓ | 9/23/16 | 9/30/16 | 10/31/16 |

- ◆ **Identifying and then establishing relationships with key stakeholders for each of the OEM's and NASA programs is req'd and an on-going activity**
 - OEM's report to SLS / MPCV programs – not to GSDO
 - Influencing these key stakeholders required
- ◆ **Numerous customer organizations and re-organizations are constantly I/W**
 - New relationships always being established
- ◆ **Integrating customer organizations within each program is required to ensure implementable solutions / plans are implemented**
 - BDEALS
 - Operational Work Agreements
- ◆ **Documenting Stakeholders / POC's Part of the Final Product**



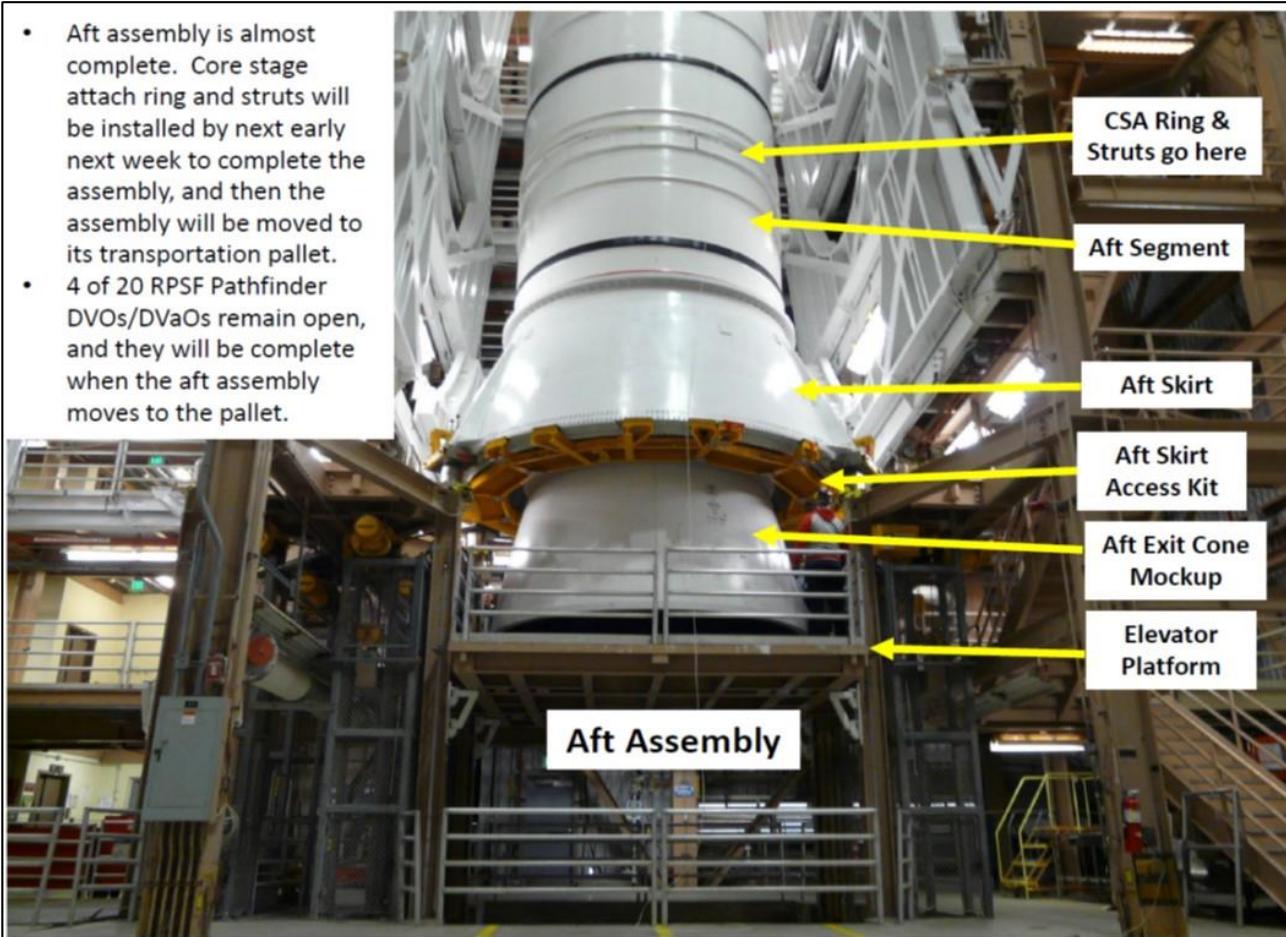
Self Propelled Modular Transporter Training Drive Core Stage off Barge at KSC

- ◆ Integrated Team (KSC, MSFC, MAF) has been meeting on SPMT training
 - Two (2) classes – Level I & II scheduled for Oct 24th, and Nov 14th
 - PO is I/W – direct between TOSC & Wheelifit – MAF can support dates
- ◆ Req'd for participation in LH2-barge to test stand transport - March, 2017



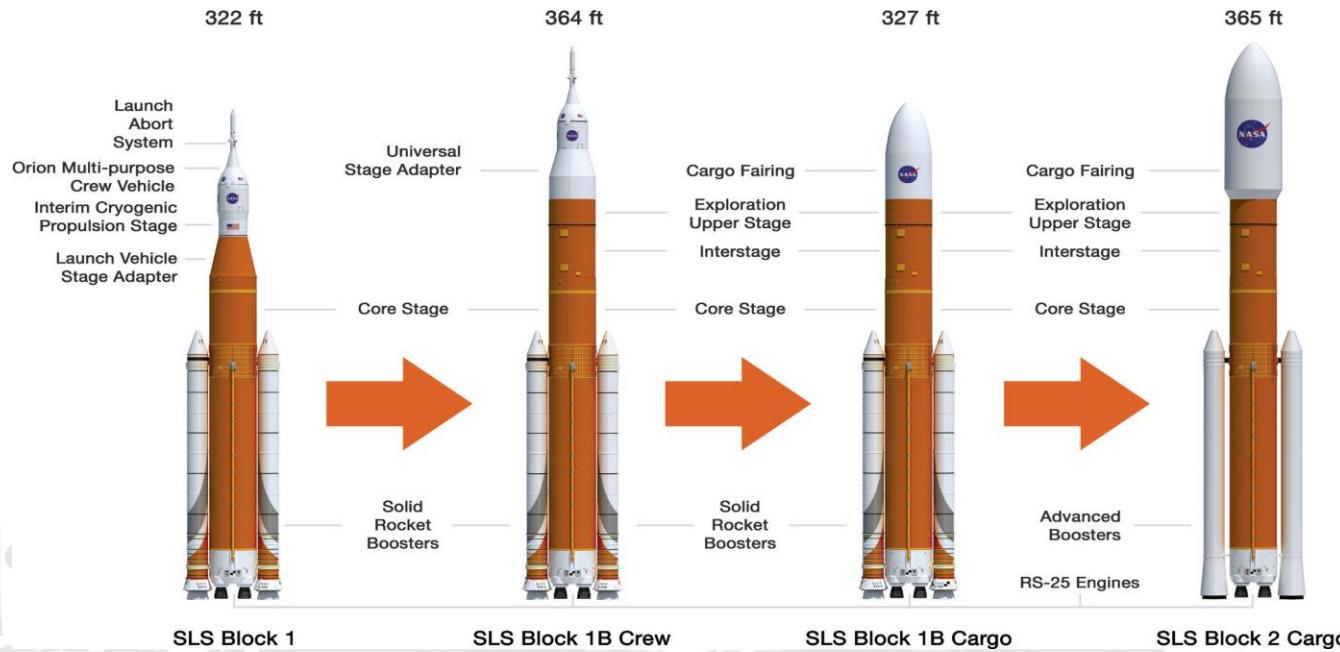
◆ RPSF Pathfinder

- Integrated technical requirements between OATK and GSDO
- Developed & baselined required documentation at NASA boards



◆ Positive impact – customer very satisfied

- ◆ **SVE and ACE positions contribute and have direct impacts to EM1 TOSC critical path activities**
 - Align with Jacob's Core Values – Growth / Relationship Based / People
- ◆ **LDP activity represented opportunity to document key elements of the positions & information / data acquired to date**
 - Share drive will have final document as well as other SVE / ACE products
- ◆ **Will ensure our continued performance for EM2 and future SLS missions**



Forward Plan

- ◆ Complete “New Resource Request Form” for the positions utilizing detailed roles & responsibility write-ups from backup slides for job description field
 - SLS SVE
 - MPSV SVE
 - ACE
 - Note: leveraged data / information obtained during the last year of job performance

- ◆ Capture the critical data associated with the positions and populate the newly created share drive – provide access to TOSC Senior Leadership
 - Relationships / established (POC's)
 - Detailed Briefings
 - Critical Data

Backup Charts



ACE Roles / Responsibilities

- ◆ The Associate Chief Engineer (ACE) assists the Chief Engineer (CE) in the execution of the duties and responsibilities of the Office of the Chief Engineer (OCE), including signature authority.
- ◆ Area of responsibility includes all Ground Systems and Ground Support Equipment at all KSC facilities that TOSC has operations, maintenance and sustaining responsibility.
- ◆ The Office of the Chief Engineer (OCE):
 - Provides policy direction, oversight, and assessment for the TOSC engineering, ground maintenance and ground processing communities and serves as principal advisor to the TOSC General Manager (GM) and other senior officials on matters pertaining to the technical readiness and execution of TOSC supported programs and projects. The OCE ensures that TOSC development efforts and processing operations are planned and conducted on a sound engineering basis with proper controls and management of technical risks.
 - Develops and maintains senior technical relationships with NASA and OEM Chief Engineering communities to address cross-program issues/concerns and develop solutions.
 - Make the final decision to resolve high level / high impact engineering (technical) issues.
 - Accepts technical risk at Material Review Boards and Engineering Review Boards.
 - Provide strong technical representation to TOSC customers (NASA, OEMs) providing reassurance of TOSC's technical ability and the overall quality of the work delivered.
 - Take responsibility for the internal technical governance and quality of all engineering deliverables to TOSC customers.
 - Provide suitable guidance and judgment regarding engineering methods, approaches, standards, and best practices.
 - Manage task delivery against Technical requirements.

SLS SVE Roles / Responsibilities

- ◆ Primary focus is working with SLS OEM's Boeing (BOE), United Launch Alliance (ULA), Orbital ATK (OATK), and Aerojet Rocketdyne (AR) along with NASA GSDO & SLS programs to coordinate the products and information TOSC needs to support GFAST and procedure development for EM-1.
 - Assess OMRS maturity, coordinate with engineering, and assign priorities to better communicate TOSC's OMRS needs and schedule to SLS OEM's.
 - Identify the GFAST OMRS's by planned GFAST drops and develop burn-down plans and BDEALS dates for the SLS OEM's to meet our development goals.
 - Coordinate BDEALS agreements between GSDO and SLS for schematics, drawings, and requirements based on needs from TOSC engineering and program integration.
 - Developing Operational Agreements (OA's) with SLS OEM's to cover the plan for their support and training for post-DD250 TOSC EM-1 processing.
 - Established and leading the integrated SPMT team between NASA centers (MAF, KSC, MSFC) to ensure TOSC personal are trained and certified prior to EM1 processing and core stage transportation operations.
 - Supporting OMRS development and review with SLS/SLS OEM's and performing RCN review for the TOSC chief engineer's office.
 - Supporting and integrating multiple F2F meetings between OEM's and GSDO/TOSC personnel to ensure smooth transition from development to operations ensuring expectations are aligned.
 - Integrating OSMS opportunities between the OEM's, TOSC, and GSDO to ensure correct items are identified and subsequently supported with the appropriate resources / skills mix.

MPCV SVE Roles / Responsibilities

- ◆ Primary focus is working with Lockheed Martin (LM) and NASA GSDO & Orion to coordinate the products and information TOSC needs to support GFAST and procedure development for EM-1.
 - Assess OMRS maturity, coordinate with engineering, and assign priorities to better communicate TOSC's OMRS needs and schedule to LM.
 - Identify the GFAST OMRS by planned GFAST drop to develop burn-down plan for LM to meet our development goals. Also providing lists of technical content and CUIs needed, to support Orion FSW planning.
 - Support the Orion ISP control board to coordinate FSW development changes with the GFAST teams and identify concerns and impacts.
 - Coordinate BDEALS agreements between GSDO and Orion for schematics, drawings, and requirements based on needs from TOSC engineering and program integration.
 - Developed an Operation Agreement (OA) with LM to define the roles and responsibilities of both contractors during GSDO/TOSC processing in the LASF in the hybrid-IOZ configuration. Worked with GSDO to document their requirements.
 - Developing an OA with LM to cover the plan for their support and training for post-DD250
 - Coordinated the Orion OSMS plan with TOSC engineering, GSDO, and Orion, which will allow TOSC personnel to witness Orion production operations and testing at the O&C, ITL, MAF, and Plumbrook.
 - Supporting OMRS development and review with LM/Orion and performing RCN review for the TOSC chief engineer's office.
 - Support LM GSE design reviews and design requirements reviews.
 - Supporting secondary payloads meetings for CubeSat processing.